

Claims:

1. A method of analyzing ions, the method comprising :
- (1) providing a stream of ions; and
- (2) providing, in an ion processing section, an energy barrier, having a magnitude between the kinetic energies of at least a first group of ions having a first charge and a second group of ions having a second, higher charge, whereby said at least a first group of ions are emptied from the ion processing section and the second group of ions are retained in the ion processing section for subsequent processing.
2. A method as claimed in claim 1 which included, between steps (1) and (2) ensuring that the energy distribution amongst the ions is sufficiently low to provide adequate separation between the first and second groups of ions, during emptying of the first group of ions and retention of the second group of ions in step (3).
3. A method as claimed in claim 2, which includes, between steps (1) and (2) thermalizing the ions by collision with a neutral gas.
4. A method as claimed in claim 2 or 3, which includes after step (3), subjecting the second group of ions to mass analysis
5. A method as claimed in claim 4, which includes operating the ion processing section as an ion trap, the method comprising:
- In step (1), injecting a stream of ions into the processing section for an injection period; and
- In step (2), terminating supply of ions to the processing section, and thermalizing ions in the ion processing section.
6. A method as claimed in claim 5 which includes providing a quadrupole rod set in the ion processing section and effecting said mass analysis within the quadrupole rod set.

SEARCHED  
INDEXED  
COPIED  
FILED  
APR 19 1988  
RECEIVED  
U.S. PATENT AND TRADEMARK OFFICE  
CUSTODIAN OF PATENT RECORDS  
U.S. GOVERNMENT

Sub  
G3

7. A method as claimed in claim 6, which includes effecting mass analysis in the processing section by scanning the second group of ions out of the quadrupole rod set by axial ejection.
8. A method as claimed in claim 7, which includes, after scanning out the second group of ions from the quadrupole rod set to effect mass analysis, applying voltages to the ion trap, to empty the ion trap
9. A method as claimed in claim 2 or 3, which includes effecting mass analysis on said at least a first group of ions emptied from the processing section in step (3).
10. A method as claimed in claim 9 which includes effecting said mass analysis using a multipole rod set.
11. A method as claimed in claim 10, which includes effecting said mass analysis using a quadrupole rod set .
12. A method as claimed in claim 9, which includes effecting said mass analysis in a time of flight mass spectrometer.
13. A method as claimed in claim 9, which includes effecting said mass analysis using a Fourier transform mass spectrometer.
14. A method as claimed in claim 9, which includes effecting said mass analysis using a 3-dimensional ion trap mass spectrometer.
15. A method as claimed in claim 9, which includes, operating the ion processing section as an ion trap, the method comprising:

In step (1), injecting a stream of ions into the processing section for an injection period; and

In step (2), terminating supply of ions to the processing section, and thermalizing ions in the ion processing section.

3rd  
Cont

SEARCHED INDEXED  
SERIALIZED FILED

16. A method as claimed in claim 9, which includes:
- (a) injecting a stream of ions into the processing section for an injection period, providing an energy barrier to permit a first group of ions having a first charge to be emptied from the processing section for mass analysis;
  - (b) resetting the energy barrier to a lower level to permit a subsequent group of ions having a higher charge to be emptied from the processing section, for separate mass analysis; and
  - (c) repeating steps (a) and (b) to enable mass analysis of each of a plurality of groups of ions having different charges.
17. A method as claimed in claim 16, which includes:
- (a) providing for injection of the stream of ions, in step (1), into the processing section, and ensuring that the ions in the processing section have said sufficiently low energy distribution; and
  - (b) after all desired groups of ions have been emptied from the processing section for mass analysis, repeating the step of injecting ions into the processing section, to provide further ions for analysis.
18. A method as claimed in claim 4, which includes, prior to supplying the stream of ions to the processing section, generating a stream of ions of an analyte, mass selecting a desired m/z of an analyte ion in a first mass analysis step, and injecting the desired ion into the processing section for analysis, wherein the mass analysis of the second group of ions comprises a second mass analysis step.
19. A method as claimed in claim 18, which includes, in the first mass analysis step mass selecting a precursor ion as the desired ion, subjecting the precursor ion to a collisional process to generate fragment ions, and passing the fragment ions and any remaining precursor ions into the processing section.

20. A method as claimed in claim 19, which includes effecting said second mass analysis step in the processing section, to mass analyze said second group of ions.
  21. A method as claimed in claim 19, which includes mass analyzing said at least two first group of ions having a first charge externally to the processing section.
  22. A method as claimed in claim 21, which includes effecting the second mass analysis step in one of a multipole mass spectrometer, a quadrupole mass spectrometer, a time of flight mass spectrometer, and a Fourier transform mass spectrometer.
  23. A method as claimed in claim 21, which includes:
    - (a) injecting a stream of ions into the processing section for an injection period, providing an energy barrier to permit a first group of ions having a first charge to be emptied from the processing section for mass analysis;
    - (b) resetting the energy barrier to a lower level to permit a subsequent group of ions having a higher charge to be emptied from the processing section for mass analysis; and
    - (c) repeating steps (a) and (b) to enable mass analysis of each of a plurality of groups of ions having different charges.

A<sup>3</sup>  
Concluid